Ag ALLOY FILM FOR ELECTRONIC PART AND SPUTTERING TARGET MATERIAL FOR FORMING Ag ALLOY FILM

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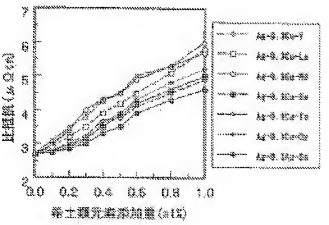
Abstract of **JP 2003293054 (A)**
PROBLEM TO BE SOLVED: To provide an Ag alloy film for electronic parts which combinedly has low electric resistance, heat resistance, corrosion resistance, and adhesion and patterning properties for a substrate, and to provide a sputtering target for forming the Ag alloy film for electronic parts. ; SOLUTION: The Ag alloy film for electronic parts contains, by atom, 0.1 to 0.5% Sm and Au and/or Cu by 0.1 to 1.0% in total, and the balance substantially Ag. The sputtering target material for forming an Ag alloy film for electronic parts contains, by atom, 0.1 to 0.5% Sm and Au and/or Cu by 0.1 to 1.0% in total, and the balance substantially Ag. ; COPYRIGHT: (C)2004,JPO



Notes:
1. Untranslatable words are replaced with asterisks (****).
2. Texts in the figures are not translated and shown as it is.

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FULL CONTENTS

[Claim(s)]
[Claim 1]An Ag alloy film for electronic parts becoming a 0.1-1.0at% hidden remainder real target from Ag in total about Au and/or Cu 0.1 - 0.5at% in Sm.
[Claim 2]The Ag alloy film according to claim 1 being a wiring film for plane display devices.
[Claim 3]The Ag alloy film according to claim 2 being a wiring film for organic electro-luminescence displays.
[Claim 4]The Ag alloy film according to claim 2 being a wiring film of a polysilicon thin-film transistor for plane display devices.
[Claim 5]The Ag alloy film according to any one of claims 1 to 4 formed on a glass substrate or a Si wafer.
[Claim 6]A sputtering target material for Ag alloy film formation for electronic parts becoming a 0.1-1.0at% hidden remainder real target from Ag in total about Au and/or Cu 0.1 - 0.5at% in Sm.

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention, for example A liquid crystal display (henceforth LCD), a plasma display panel. (It is hereafter called PDP), a field emission display. (It is hereafter called FED), electroluminescence (henceforth EL), In [in addition to plane display devices (a flat-panel display and henceforth / FPD /) such as an electrophoresis type display used for electronic paper etc.,] thin film electronic parts, such as various semiconductor devices, a thin film sensor, and a magnetic recording head, It is related with the Ag alloy film for electronic parts and the sputtering target material for Ag alloy film formation of which low electric resistance, corrosion resistance and a heat-resisting property, and adhesion are required.
[0002]
[Description of the Prior Art]FPD(s), such as LCD and PDP which produce a thin film device on a glass substrate, and ****EL**********, The alloy film which makes a subject pure metal films, such as a pure Cr

film which is metal which is excellent in corrosion resistance, a heat-resisting property, and adhesion with a substrate from the former, a pure Ta film, an unalloyed ti film, and pure aluminum, or them is used for the electric wiring film used for the magnetic recording head etc. which form an element on a thin film sensor and a ceramic substrate, and the electrode. In recent years, the above metal membranes for thin film devices require the metal membrane of low electric resistance. In particular, in the field of FPD, although the thin-film transistor (TFT) method in which enlargement, highly-minute-izing, and a high-speed response are possible is adopted widely, the wiring film has the demand of low-electric-resistance-izing, in order to prevent signal delay. For example, in the wiring used for large-sized color LCD of 12 inches or more used for a notebook computer etc., specific resistance. [below 30microomegacm] 15-inch more large-sized desktop PCs are required to be referred to as 10 or less microomegacm, and the high definition, and the liquid crystal television and the small Personal Digital Assistant as which a high-speed response is required will require the metal membrane of the further low electric resistance further from now on.

[0003]for this reason, Cr which was excellent in these wiring films at corrosion resistance or adhesion and Ta -- the aluminum alloy which added Ti, Ta, Nd, etc. is used for aluminum which is electric resistance still lower Mo of low electric resistance, the alloy film of W, and now from that alloy.

[0004]Especially an aluminum-Nd alloy film is excellent in corrosion resistance, a heat-resisting property, and adhesion in an aluminum alloy, A development also has few hillocks by heating of the process at the time of manufacturing a thin film device, The specific resistance in the state where membranes were furthermore formed on the substrate of a room temperature can be decreased to about 5 microomegacm by performing heat-treatment at not less than 250 **, etc. with 15microomegacm, although it is high, and it is known that it is a metal membrane which has outstanding characteristics. However, even if it is an aluminum alloy film, it cannot be said that it is enough in order to realize improvement in the high-speed response corresponding to the further highly-minute-izing demanded on a future large-sized display, the display for portable devices, etc., and an animation.

[0005]In the liquid crystal display, development of liquid crystal TV etc. which used now the polysilicon TFT drive system [drive system / mainstream / amorphous silicone TFT] which can be answered high-speed is furthered. In the manufacturing process of polysilicon TFT, since it becomes process temperature still higher than the manufacturing process of amorphous silicone TFT, a still higher heat-resisting property is required of a wiring material. For this reason, heat-resisting property sufficient in an aluminum alloy with a low melting point is not securable. moreover -- using polysilicon TFT as a drive element -- self--- the organic EL display attracts attention as a plane display device [****]. In the organic EL display, since it becomes the current drive unlike a liquid crystal display, wiring of still lower electric resistance is called for. Therefore, it changes to an aluminum alloy and application of Ag which is low electric resistance further is considered.

[0006]Especially, in the small Personal Digital Assistant, it changes to a glass substrate etc. for shock resistance or a weight saving, and the plane display device using a resin substrate, a resin film, etc. is demanded. Heat-treatment is required to obtain the wiring film of low electric resistance with an aluminum alloy like previous statement, and since heat-treatment sufficient in the case of a resin substrate, a resin film, etc. cannot be performed, the fault of being difficult to get also has low electric resistance. For this reason, also in the process which does not heat-treat, the indication of Ag of low electric resistance is considered from the aluminum alloy.

[0007]

[Problem to be solved by the invention]It has the fault that the melting point of Ag is higher than aluminum, the adhesion over the substrate which it is promising as a future wiring material since it is low electric resistance, but is used for a plane display device is low, and a heat-resisting property and corrosion resistance are still lower, as mentioned above. For example, when Ag is used as a wiring film of FPD, the problem that the adhesion of the film to substrates, for example, glass, a Si wafer, a resin substrate, a resin film, and a corrosion-resistant high metallic foil, for example, stainless steel foil etc., etc., is low, and peeling arises in a process is produced. Film grains may condense under the influence of the substrate quality of the material or heating atmosphere at the time of the development of a hillock, and plane display device manufacture, and electric resistance may increase sharply by the smooth nature of a membrane surface falling or losing membranous continuity. After corrosion resistance originated in the low thing and formed membranes on the substrate, there was a problem of discoloring only by neglecting it to the air on several, or it being corroded by the drug solution used at the time of manufacture of a display, and electric resistance rising sharply, or a film exfoliating.

[0008]In order to solve the above-mentioned problem, [the method of using for JP,H8-260135,A the Ag alloy target as for which more than 0.1%at added Cu to Ag] The electrode substrate for reflection type displays using the alloy which adds Pt, Pd, Au, Cu, and nickel on a glue line at Ag is proposed by JP,H11-119664,A. moreover -- JP,2001-192752,A -- Ag -- Pd -- 0.1 - 3wt%, aluminum, Au, Pt, Cu, Ta, Cr, Ti, nickel, Co, Si, etc. -- the sum total -- 0.1 - 3wt% -- the electronic parts using the alloy to add -- public funds -- group material etc. are proposed.

[0009]However, when an element is added by the method indicated by these, the increase in electric resistance is large and low electric resistance, adhesion, and the alloy film with which it can be satisfied of corrosion-resistant and heat-resistant all cannot be obtained. If elements which are Ta, Cr, Ti, nickel, Co, etc. which are transition metals, for example, and semimetal, such as aluminum and Si, are added, electric resistance will increase, and if content exceeds 1at%, specifically, specific resistance will exceed 5microomegacm. When Pd, Pt and Au which are precious metal elements, and Cu which is congeners are added, there are few increases in electric resistance, but there is a problem in a heat-resisting property.

[0010]The purpose of this invention is to provide the sputtering target for forming the Ag alloy film for electronic parts which has low electric resistance and heat-resisting property, corrosion resistance, the adhesion to a substrate, and patterning nature, and its Ag alloy film for electronic parts.

[0011]

[Means for solving problem][by carrying out compound addition of the element chosen as Ag, and considering it as an Ag alloy film, as a result of inquiring wholeheartedly so that this invention persons may solve above-mentioned SUBJECT] Corrosion resistance was improved without spoiling greatly the low electric resistance which Ag originally has, it found out that the adhesion to a substrate and patterning nature were also further improvable, and this invention was reached.

[0012]That is, this invention is an Ag alloy film for electronic parts which becomes a 0.1-1.0at% hidden remainder real target from Ag in total about Au and/or Cu 0.1 - 0.5at% in Sm.

[0013]This inventions are a plane display device, for example, an organic EL display, and an Ag alloy film of the above-mentioned presentation which is a wiring film for polysilicon TFT for plane display devices.This invention is an Ag alloy film of the above-mentioned presentation formed on the glass substrate or Si wafer used for a plane display device.

[0014]This invention is a sputtering target material for Ag alloy film formation for electronic parts which becomes a 0.1-1.0at% hidden remainder real target from Ag in total about Au and/or Cu 0.1 - 0.5at% in Sm.
[0015]
[Mode for carrying out the invention]The feature of this invention is in the place which found out the optimal alloy composition for compensating the adhesion, the corrosion resistance, and the heat-resisting property which are the faults which Ag has, maintaining the low electric resistance of the Ag itself as much as possible.
[0016]Usually, when Ag film is produced, the electric resistance as a film is low, but it is as above-mentioned that various problems occur on the process at the time of manufacturing plane display devices (for example, liquid crystal display etc.). That is, film growth, condensation, etc. by heating take place, a membrane surface serves as more irregular shape, or a void generates it. And a membrane surface discolors depending on the heating atmosphere, and it becomes a cause of increase of electric resistance. With then, the thing to do for compound addition, [this invention] [Ag] [Sm, and Au and Cu] [Sm, Au Sm, Cu, or] It becomes possible to control deterioration of the film itself and to improve the adhesion in tops, such as a heat-resisting property, corrosion resistance, a glass substrate, a Si wafer further for plane display devices that are the faults of Ag, and the patterning nature by photoetching. For this reason, plane display devices, such as an organic EL display using the Ag alloy film for electronic parts and Ag alloy film which have outstanding characteristics, can be obtained.
[0017]Sm which is an alloying element in the Ag alloy film for electronic parts of this invention below -- 0.1 - 0.5at%, Au, and/or Cu -- the sum total -- 0.1 - 1.0at% -- the Reason to contain is explained. If an alloying element is added to Ag, electric resistance will increase, but the heat-resistant and corrosion-resistant improvement effect by an alloying element improves with the increase in the amount of addition. For this reason, maintaining low electric resistance, for improving the fault of above-mentioned Ag, though it is the required minimum quantity, it is necessary to adjust an alloying element so that sufficient effect may be acquired.
[0018]First, the effect at the time of adding each element independently is described. The effect by containing Sm is the point that the corrosion resistance and the heat-resisting property of an Ag alloy film are improvable. Although the improvement effect appears from 0.1at%, if 0.5at% is exceeded, on the other hand, the electric resistance of what [excellent] will increase the content of Sm to corrosion resistance or a heat-resisting property. And in order to obtain lower electric resistance, it is desirable to make the amount of addition of Sm less than 0.3at%. Film peeling is produced in the washing process etc. which manufacture a plane display device, and it is insufficient for an improvement of adhesion just to have added Sm independently.
[0019]The effect by containing Cu and Au is the point that adhesion is improvable. Although the content of Cu and Au appears [the adhesion effect] from 0.1at%, if 1.0at% is exceeded by Cu on the other hand, the increase in electric resistance will become large. the case of Au -- more than 1.0at% -- even if it adds, the increase in electric resistance is small, but if 0.5at% is exceeded, it will become easy to generate residues at the time of etching, and if 1.0at% is exceeded, residues will increase, and patterning nature falls. For this reason, in order to obtain better patterning nature, it is more desirable to make the amount of addition of Au and Cu less than 0.5at%. If only Cu and Au were added, it was insufficient for the corrosion resistance and the heat-resistant improvement to the various medicine and environment in the inside of the process at the

time of manufacturing a plane display device.

[0020]If Sm, Cu, and Au are independently added, respectively in order to obtain the Ag alloy film which has low electric resistance, corrosion resistance, a heat-resisting property, adhesion, and patterning nature as above-mentioned, since it is insufficient, Compound addition of Sm which has an effect in a corrosion-resistant and heat-resistant improvement, and Au and/or Cu which have an effect in an improvement of adhesion was carried out.

[0021]Each amount of the minimum addition in that case is more than 0.1at%, and the point that the improvement effect of membrane characteristics appears from 0.1at% of the amount of addition is as above-mentioned. in this invention, by boiling a very small quantity and carrying out compound addition, membranous grain growth can be controlled further and it can be considered as the Ag alloy film of precise and smooth surface type voice rather than adding Sm, Au, and Cu by an each independent to Ag. For this reason, the void in a film can decrease and it can be considered as the corrosion-resistant improvement by inhibition of the increase in electric resistance, and inhibition of intergranular corrosion, and the Ag alloy film which has improved adhesion by reduction of membrane stress further.

[0022]Sm made each amount of addition maximums in the case of carrying out compound addition less than 1.0at% in less than 0.5at%, Au, a Cu independent, and compound addition of Au and Cu because it would be hard coming to obtain the Ag alloy film which combines low electric resistance and patterning nature if this amount of addition is exceeded. If 0.5at% is exceeded, it will become easy to generate etching residues and patterning nature will fall, but Au becomes possible [removing residues by washing carefully].

[0023]for this reason, that content -- Sm -- 0.1 - 0.5at%, Au, and/or Cu -- the sum total -- 0.1 - 1.0at% -- the Ag alloy film for electronic parts which has characteristics excellent in containing can be realized, and it becomes possible to obtain the film optimal as wiring films for plane display devices, such as an organic EL display. in order to obtain inhibition of a fall of the patterning nature which considers the development of the etching residues of Au as a reason, and the Ag alloy film of lower electric resistance -- Sm -- 0.1 - 0.3at%, Au, and/or Cu -- the sum total -- 0.1 - 0.5at% -- it is more desirable to consider it as the Ag alloy film to contain.

[0024]The Reason of the improvement effect of the membrane characteristics by the above-mentioned alloying element of this invention is guessed as follows, although it is not clear. Usually, in the film formed by sputtering etc., the element added dissolves by super saturation in a matrix, and it becomes possible to use a detailed film by controlling movement of an atom. Cu and Au are Ag and a congener, there is little turbulence of the electronic state at the time of adding, and there are few increases in electric resistance. Especially Au is an element which are all the rate dissolution elements and is mixed easily. While Sm which is rare earth elements tends to form Ag, Cu, Au, and a compound, changes the character of Ag and raises corrosion resistance, In a heating process, it deposits to a grain boundary as a compound with Ag, Cu, and Au, and while raising a heat-resisting property by controlling grain growth, intergranular corrosion is controlled and it is thought that corrosion resistance is raised.

[0025]It is as above-mentioned that, as for Ag, there is originally a problem in adhesion etc. It is thought that Cu and Au which are congeners control condensation of Ag by barring movement of an atom that it is easy to dissolve in Ag, and are raising adhesion. For this reason, by carrying out minimum quantity compound addition of Cu and Au which dissolve easily with a congener to Ag, and the Sm which is rare earth elements which are easy to form these elements and compounds, it excels in corrosion resistance, a heat-resisting

property, adhesion, and patterning nature, and it is thought that a low electric resistance Ag alloy film is obtained.

[0026]There are few increases in electric resistance and the Reason for having selected Sm in rare earth elements is a sake, when [, such as Y, La, and Nd,] it adds comparatively as compared with a light-rare-earth element. Although this Reason is not clear, since an atomic radius is small and closer to Ag than La and Nd, the crystal lattice of Ag is confused and Sm is considered because it is few and the effect which checks a motion of a free electron is low, when it adds. Since Sm cannot oxidize easily in rare earth elements as compared with Y, Sc, etc., it can obtain a raw material stably. For this reason, it becomes possible to manufacture stably the sputtering target used when forming an Ag alloy film. Although Tb etc. are considered in addition to Sm as for such rare earth elements, since these elements are expensive, Sm is most suitable industrially.

[0027]As a substrate used when forming the Ag alloy film for electronic parts of this invention, it is preferred to use a glass substrate and a Si wafer. These substrates are heating a substrate, when forming the Ag alloy film of this invention while excelling in process stability when manufacturing a plane display device, and it is because it becomes possible to obtain the Ag alloy film which has electric resistance lower than the case where membranes are formed at a room temperature, and high adhesion.

[0028]After the Ag alloy film of this invention forms a film, it becomes possible to consider it as the film of low electric resistance further by heat-treating a substrate. It becomes a low electric resistance Ag alloy film of 2.5 or less microomegacm by heating especially at the temperature of not less than 150 ** at 3 more or less microomegacm and the temperature of not less than 250 more **. For this reason, it is suitable for wiring films which have the process of forming polysilicon TFT which has a heating process using a glass substrate and a Si wafer, such as an organic EL display and a liquid crystal display. There was no alloy film with which it can be satisfied of many characteristics like [if old Ag-Cu alloy and Ag-Pd alloy also heat-treat, although electric resistance falls, when electric resistance is low, neither adhesion nor a heat-resisting property is enough / electric resistance /, and] this invention.

[0029]When forming the Ag alloy film for electronic parts of this invention, sputtering using a target material is the optimal. It is because the film of the presentation can be mostly formed with a target material by the sputtering method, and it becomes possible to form the Ag alloy film of this invention stably. For this reason, this invention is a sputtering target material for Ag alloy film formation which has the same presentation as the Ag alloy film for electronic parts.

[0030]What is necessary is just to be able to attain a high grade, a uniform organization, high density, etc. which are generally required of a target material, although it is variously about a manufacturing method of a target material. For example, a molten metal adjusted to a predetermined presentation with a vacuum melting process is cast to metal molds, tabular is further processed by forging, rolling, etc. after that, and it can manufacture by making a target of predetermined shape by machining. In order to obtain a uniform organization, ingots which carried out rapid solidification, such as a powder sintering process or the spray foaming method (the drop depositing method), may be used.

[0031]Although constituent elements other than Sm and Au which mentioned above a sputtering target material for Ag alloy film formation of this invention for electronic parts, and Cu are substantially set to Ag, In the range which does not spoil an operation of this invention, inevitable impurities, such as aluminum of Fe, Co and nickel which are oxygen, nitrogen and carbon which are gas constituents, and a transition metal, and

a half a carat group, and Si, may also be included. For example, respectively, 100 ppm or less and aluminum are 500 ppm or less etc., and 50 ppm or less, Fe, nickel, and Co of oxygen of gas constituents, carbon, and nitrogen should just be not less than 99.9% as purity except gas constituents.

[0032]Although a glass substrate, a Si wafer, etc. are preferred for a substrate used when manufacturing a C-scan display element as mentioned above, it can form a thin film by sputtering and a resin substrate, a metal substrate, other resin foil, a metallic foil, etc. are just sufficient as it.

[0033]As for the Ag alloy film for electronic parts of this invention, in order to obtain the stable electric resistance, it is preferred to be referred to as 100-300 nm as thickness. Since the film is [be / thickness / less than 100 nm] thin, while electric resistance will rise under the surface dispersion influence of electronic, membranous surface type voice changes easily. It is to take time and for productivity to fall on the other hand, when an electric resistance value is low when thickness exceeds 300 nm, but a film becomes being easy to separate by membrane stress or a film is formed.

[0034]

[Working example](Embodiment 1) In order to check the influence of [at the time of carrying out compound addition of Cu, Au, and the rare earth elements] to Ag, adding 0.3at% of Cu or Au to Ag -- further -- rare earth elements (Y.) The casting Ag alloy ingot to which the amount of addition of La, Nd, Sm, Tb, and Dy was changed, respectively was produced with vacuum melting casting, and after processing tabular by cold rolling, the sputtering target material (100 mm in diameter and 5 mm in thickness) was produced by machining. Next, using the Ag alloy target material, the Ag alloy film of 200 nm of thickness was formed on the glass substrate by the sputtering method, and specific resistance was measured at the room temperature by 4 probe method. The result is shown in drawing 1.

[0035]If the amount of addition increases every rare earth elements, electric resistance will increase, as shown in drawing 1. It turns out that the electric resistance of the Ag alloy film at the time of adding Sm, Tb, or the Dy is lower than the Ag alloy film which added Y, La, or Nd in rare earth elements. Thus, Sm, Tb, and Dy are desirable as an alloying element in rare earth elements. However, since Tb and Dy are expensive, their Sm of this invention is the optimal in an alloying element. If the amount of addition exceeds 0.5at%, specific resistance will exceed 4microomegacm, and the merit of the low electric resistance which Ag has is lost. For this reason, as an amount of addition of Sm, less than 0.5at% is desirable. In order to obtain the lower specific resistance of 3 or less microomegacm, 0.3at% is preferred as an amount of addition. moreover -- replacing with Cu -- Au -- 0.3at% -- when it adds, electric resistance increases with the increase in the amount of addition of Sm like Cu, but it turns out that electric resistance still lower than Cu is obtained.

[0036](Embodiment 2) The quantity of Sm added to Ag was fixed to 0.3at%, the casting Ag alloy ingot to which the amount of addition of Cu, Au or Pd, Ru, and nickel was changed, respectively was produced, and the sputtering target material was produced like Embodiment 1. The Ag alloy film of 200 nm of thickness was formed on the glass substrate by the sputtering method using the Ag alloy target material, and specific resistance was measured like Embodiment 1. The result is shown in drawing 2.

[0037]Electric resistance increases with the increase in the amount of addition as shown in drawing 2. It turns out that the increase in electric resistance has few Ag alloy films which added Cu and Au from Ru, nickel, and Pd in it. In Cu, it turns out that the low specific resistance of 4 or less microomegacm is maintainable at less than 1.0at%. Especially Au can maintain the low specific resistance of 4 or less

microomegacm, even if the increase in specific resistance adds to 1.5at% few. For this reason, Sm understands [a Cu independent] that it is desirable not to exceed 1.5at% by less than 1.0at% and an Au independent as an amount of addition in the case of carrying out compound addition of Cu or the Au.

[0038]The heat-resisting property at the time of carrying out compound addition of Sm, Cu, and Sm and Au, corrosion resistance, adhesion, and patterning nature were evaluated to (Embodiment 3), next Ag. In order to evaluate electric resistance after passing through the manufacturing process as predetermined products, The specific resistance at the time of membrane formation, the specific resistance after carrying out temperature of 250 ** and heat-treatment of 2 hours in a vacuum, and the specific resistance after neglecting 24h by the environment of the temperature of 85 ** and 90% of humidity as a corrosion test were measured about the pure Ag film and Ag alloy film which were formed by 200-nm thickness on the glass substrate and the Si wafer. In order to evaluate membranous adhesion, after putting a break into the pure Ag film and Ag alloy film which heat-treated in a grid pattern at intervals of 2 mm, the tape was stuck and torn off to the membrane surface. The grid which remained on the substrate on that occasion was denoted by the area rate, and it evaluated as adhesion. [the metal membrane which gave the above-mentioned heat-resistant evaluation as evaluation of patterning nature] Tokyo -- adaptation -- make OFPR-800 resist was applied with the spin coat, negatives were developed after exposing a resist by ultraviolet radiation organic alkali developer NMD-3 using the photomask, the resist pattern was produced, it etched with the mixed liquor of phosphoric acid, nitric acid, and acetic acid, and the Ag alloy film pattern was formed. It observed with the optical microscope about the shape of the edge, the residues of the circumference, etc., and it was estimated that what does not have film peeling and does not have residues was good. The result of the above measurement and evaluation is shown in Table 1.

[0039]

[Table 1]

No	組成（ａｔ％）	比抵抗（μΩｃｍ）			密着性（％）	パターニング性	区分
		成膜時	加熱処理後	耐食試験後			
1	Ag	2.7	1.8	3.2	50	膜剥れ	比較例
2	Ag-0.05Sm	2.7	1.8	3.0	55	膜剥れ	比較例
3	Ag-0.1Sm	2.9	1.9	3.0	60	膜剥れ	比較例
4	Ag-0.3Sm	3.1	2.3	3.2	60	膜剥れ	比較例
5	Ag-0.6Sm	4.2	2.8	4.1	55	膜剥れ	比較例
6	Ag-0.3Sm-0.05Cu	3.2	2.3	3.2	60	膜剥れ	比較例
7	Ag-0.3Sm-0.1Cu	3.2	2.3	3.3	75	良好	本発明例
8	Ag-0.3Sm-0.5Cu	3.2	2.4	3.2	85	良好	本発明例
9	Ag-0.1Sm-0.4Cu	2.9	2.0	2.8	80	良好	本発明例
10	Ag-0.3Sm-1.0Cu	3.8	2.5	3.8	85	良好	本発明例
11	Ag-0.5Sm-0.1Au	3.4	2.7	3.2	75	良好	本発明例
12	Ag-0.2Sm-0.4Au	3.0	2.5	3.0	85	良好	本発明例
13	Ag-0.15Sm-0.8Au	3.0	2.9	3.1	85	残さ有るが洗浄後良好	本発明例
14	Ag-0.15Sm-1.0Au	3.8	3.5	3.5	85	残さ有るが洗浄後良好	本発明例
15	Ag-0.2Sm-0.2Cu-0.2Au	3.0	2.5	3.1	80	良好	本発明例
16	Ag-0.3Sm-0.5Cu-0.5Au	3.4	2.9	3.6	85	良好	本発明例
17	Ag-0.9Pd-1.7Cu	4.1	3.0	4.3	65	良好	比較例
18	Ag-0.8Sm-0.9Pd	4.1	3.0	4.3	80	良好	比較例
19	Ag-0.3Sm-0.4Ru	8.5	6.2	7.9	65	良好	比較例
20	Ag-0.3Sm-0.5Cu	3.2	2.4	3.2	80	良好	本発明例
21	Ag-0.2Sm-0.4Au	3.0	2.5	3.0	80	良好	本発明例

Ｎｏ．１～１９はＡｇ合金膜をガラス基板上に形成した試料、Ｎｏ．２０及び２１はＡｇ合金膜をＳｉウェハー上に形成した試料である。

[0040]If it heat-treats by a pure Ag film (No.1) having the low specific resistance of 3.0 or less microomegacm at the time of membrane formation, specific resistance will fall further. However, the adhesion is low and it turns out that film peeling arises and patterning nature is inferior. When Sm is added to Ag (No.2-5), even after doing a heat test and a corrosion test, low specific resistance can be maintained, but in patterning nature evaluation, film peeling will arise like [adhesion is low and] pure Ag. Although it has specific resistance equivalent to an Ag alloy film of this invention in an Ag alloy film (No.17) which added Pd and Cu to Ag by which the conventional proposal is made, while corrosion resistance is low and electric resistance increases after a corrosion resistance test, it turns out that adhesion is low.

[0041]On the other hand, [Ag of this invention] [an Ag alloy film (No.7-16) which carried out compound addition of Sm, Cu Sm, Au and Sm, and Cu and Au] Specific resistance at the time of membrane formation is as low as 4 or less microomegacm, and it turns out that low specific resistance is maintained, and adhesion is also sharply improved also after heat treatment and a corrosion test, and also it excels in patterning nature. And the improvement effect improves by the increase in the above-mentioned amount of addition, and becomes clear [an effect of each element] at more than 0.1at%. However, when the amount of addition of Au exceeds 0.5at%, residues are checked after etching and it may be inferior to patterning

nature, but it becomes possible to remove residues by washing carefully. For this reason, in order to obtain an Ag alloy film excellent in low electric resistance and a heat-resisting property, corrosion resistance, and patterning nature, it is desirable to carry out Sm and to make Au and Cu into 0.1 in all to 1.0 at% 0.1 - 0.5at%.

[0042]After passing through the heating process which is needed with a plane display device etc., in order to obtain the lower specific resistance of 2.5 or less microomegacm, it is desirable for Sm to consider it as 0.1 - 0.3at%, and for Au and Cu to make it less than 0.5at%. It turns out that specific resistance is not set to 2.5 or less microomegacm even if it will carry out with 250 ** heat-treatment, if the amount of addition increases more than it. About Au, if the amount of addition increases, while resistance will increase after heat-treatment, less than 0.5at% is preferred also from etching residues arising at the time of patterning. For this reason, as for Sm, in order to obtain the Ag alloy film excellent in low electric resistance and heat-resisting property, corrosion resistance, and patterning nature, it is preferred about Cu and Au to consider it as 0.1 - 0.5at% in total 0.1 - 0.3at%. Although No.20 and 21 were the samples in which the Ag alloy film was formed on the Si wafer, as for the passage clear also from Table 1, the same result as the case where an Ag alloy film is formed on a glass substrate was obtained.

[0043](Embodiment 4) The target material of Ag-0.3at%Sm-0.5at%Au and Ag-0.3at%Sm-0.5at%Cu was created like Embodiment 1, and it formed by 200-nm thickness on the Si wafer. After measuring specific resistance, after giving heat-treatment of 1 hour at 150 **, 200 **, 250 **, and 350 ** in a vacuum further, specific resistance was measured, and it asked for the change of electric resistance to heat-treatment temperature. The result is shown in drawing 3.

[0044]Specific resistance falls with the rise of cooking temperature. Especially an Ag-0.3at%Sm-0.5at% Cu alloy has the large fall of the electric resistance by cooking temperature, and 2.5 or less microomegacm and the low specific resistance below 2.0microomegacm are obtained above 300 ** at the temperature of not less than 200 **. The specific resistance of 2.5 or less microomegacm is obtained at the temperature of not less than 250 ** also by Ag-0.3at%Sm-0.5at%Au. Although a pure Ag film also serves as still lower specific resistance, it is as above-mentioned that adhesion and corrosion resistance are inferior. Thus, lower specific resistance is obtained by heat-treating, and the Ag alloy film of this invention is the best for the wiring for electronic parts accompanied by heat-treatment. It becomes possible to manufacture a quality plane display device [**** / at high speed] by using for wiring of polysilicon TFT for plane display devices especially with high cooking temperature.

[0045](Embodiment 5) Next the target material of Embodiment 4 is used and the result of having measured change of the specific resistance at the time of heating a substrate for a 200-nm Ag alloy film at 100-250 ** on a glass substrate at the time of membrane formation is shown in drawing 4. By heating a substrate and forming membranes, it turns out that specific resistance decreases. Especially the fall of specific resistance is large at the cooking temperature at not less than 150 **, and if it heats at not less than 200 **, the low specific resistance of 2.5 or less microomegacm will be obtained for Ag-0.3at%Sm-0.5at%Cu and Ag-0.3at% Sm-0.5at%Au. Adhesion improves with 85 to 90% by heating a substrate and forming membranes. Thus, on the glass substrate which has a heat-resisting property, it becomes possible to obtain an Ag alloy film with low electric resistance and adhesion by performing substrate heating. For this reason, it is suitable as wiring for electronic parts which heats a glass substrate and forms an Ag alloy film.

[0046]

[Effect of the Invention]If it is this invention as mentioned above, it is possible to obtain the Ag alloy film for electronic parts which has improved low electric resistance and heat-resisting property, corrosion resistance, and adhesion with a substrate. Therefore, it is useful to wiring films, such as an organic EL display using a high definition and the plane display device with which a high-speed response is demanded, for example, polysilicon TFT as which a high heat-resisting property is required, and industrial utility value is high.

[Brief Description of the Drawings]

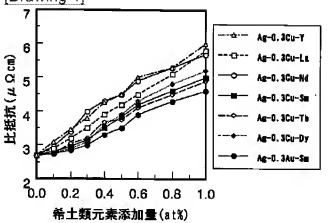
[Drawing 1]Drawing 1 is a graph in which the amount of addition of rare earth elements and the relation of the specific resistance of an Ag alloy film are shown about the Ag alloy film of Embodiment 1.

[Drawing 2]Drawing 2 is a graph in which the amount of addition of an alloying element and the relation of the specific resistance of an Ag alloy film are shown about the Ag alloy film of Embodiment 2.

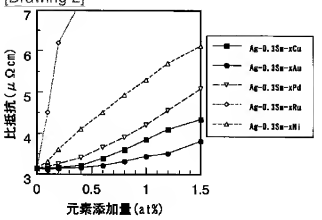
[Drawing 3]Drawing 3 is a graph in which a membranous heat-treatment temperature and the relation of the specific resistance of an Ag alloy film are shown about the Ag alloy film of Embodiment 4.

[Drawing 4]Drawing 4 is a graph in which the cooking temperature of a substrate and the relation of the specific resistance of an Ag alloy film which form a film are shown about the Ag alloy film of Embodiment 5.

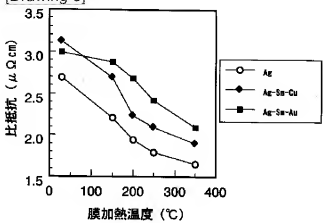
[Drawing 1]



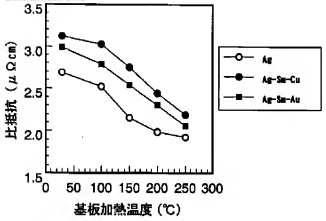
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Translation done.]